

# Capital flows and asset prices: empirical evidence from emerging and developing economies

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# Empirical Evidence from Emerging and Developing Economies

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**Abstract**

*This paper aims at providing empirical evidence on the effect of capital flows on asset prices including its channel under different currency regimes, focusing on ten emerging and developing economies in the world with data availability and stationarity for the 2000s, by a generalized impulse response analysis under a vector auto-regression model. The main findings are as follows. Portfolio capital inflows have a significantly positive effect on stock prices in all sample economies except two transition economies, which implies that the direct channel from capital inflows into stock markets is at least working in sample economies regardless of their currency regimes; The indirect channel –the channel in which capital inflows raise share prices through an increase in domestic monetary base– works differently under different currency regimes: it works in the economies with peg regime through their intervention to foreign exchange markets, whereas the indirect channel seems to be shut down in those with floating regime probably by sterilizing the intervention.*

Key Words: capital flows, asset prices, emerging and developing Economies.

JEL Classification Codes; E51, E52, F32

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# Capital Inflows and Asset prices:
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## 1. Introduction

Capital flows to emerging and developing economies in the world have increased significantly since the 2000s. In particular, the emerging markets in Asia and Latin America have been marked by massive capital inflows because of their better economic fundamentals, higher growth prospects and their perceived under-valued domestic currencies against the US dollar. After the 2008 global financial crisis, the monetary easing in advanced economies and some expectation on their exits have been giving a great influence on capital inflows towards emerging markets and also capital outflows from them. In some cases, capital flows have become significantly high relative to the size of domestic capital markets with a potentially large direct impact on their asset prices.

It has been believed that the capital inflows towards emerging and developing economies have been basically useful for raising their economic growth, and thus these economies have adopted policies to attract capital inflows. However, if substantial capital inflows, particularly portfolio investments are not managed in an appropriate manner, it might lead to financial risks such as boom-bust cycles resulting in a crisis for emerging and developing economies. Large capital inflows, for instance, may lead to excessive foreign borrowing and foreign currency exposure, possibly fueling domestic credit booms and asset bubbles. When capital flows reverse suddenly, however, a boom stage of credit expansion and asset price hikes may be turned into a bust stage, and the economies may finally suffer from serious financial and economic crisis. As a matter of fact, under these concerns on financial risks of massive capital inflows, some of emerging market economies, e.g. Korea, Indonesia, Thailand and Peru, have taken domestic prudential measures and even capital controls mainly on short-term capital transactions since 2009.

Caballero and Krishnamurthy (2006) provided theoretical insights on the nexus between capital inflows and asset bubbles in emerging market economies. They argued that emerging market economies present a fertile macroeconomic environment for the emergence of "bubbles dynamics", since a shortage of stores of value, i.e. dynamic inefficiency, caused by the "financial repression" in their financial systems tends to create a space for bubbles on unproductive assets

to arise. They also proposed a set of aggregate risk management policies to alleviate the bubble-risk, such as liquidity requirements on the banking system, sterilization of capital inflows and structural policies aimed at developing public debt markets. Aoki et al. (2009) further developed a framework to analyze "bubbles dynamics" focusing capital flows on international transaction of private debts and equities, and predicted that when the domestic financial system is underdeveloped, the economy experiences a short-run boom with capital inflow and asset price hikes after capital account liberalization, which is not sustainable in the long run. These theoretical frameworks tell us how important the issue on capital flows and asset prices is for emerging and developing economies.

Related to the aforementioned theoretical consideration, there have been limited studies to empirically investigate the nexus between capital flows and asset prices, which focus mainly on Asian emerging economies. Kim and Yang (2009) represented empirical evidence on the impacts of capital inflows on asset prices in the case of Korea, using a vector auto-regression (VAR) model. They found that capital inflow shocks have contributed to the stock price increase, but not much to the increase in land prices due to a limited effect on the liquidity, and concluded that the influence of capital inflow shocks seems to be limited in other parts of the economy than stock markets, implying that the possibility of the boom–bust cycle is relatively low in Korea. Kim and Yang (2011) extended the analysis of Kim and Yang (2009) to those in Asian emerging economies, and found that capital inflows indeed have contributed to asset price appreciation in the region, but capital inflow shocks explain a relatively small part of asset price fluctuations. Tillmann (2012) also estimated the impact of capital inflows on house prices and equity prices in Asian emerging economies using panel VAR model for a post-2000 sample. The key findings were: first, capital inflow shocks significantly push up house and stock prices; second, capital inflow shocks account for twice the portion of overall asset price changes they explain in OECD countries, and third, cross-country difference in asset price responses to capital inflow shocks are not due to the heterogeneity of market characteristics and the use of macro-prudential policies but due to differences in the monetary policy response to the shocks. As far as the limited evidence above is concerned, the impacts of capital flows on asset prices are identified in Asian emerging economies in general, but the degree of them differ across economies according to e.g. their monetary policies.

This paper helps to place the ongoing concerns on capital flows and asset prices in emerging and developing economies in the context of observed facts, and to enrich empirical evidence on

their relationship, which is strategically important in investigating whether the recent capital flows have been involved in bubble dynamics, i.e. boom-bust cycle in emerging and developing economies. To be specific, our analytical concerns for emerging and developing economies are whether capital flows are really responsible for recent fluctuations of asset prices; and if so, through which channels capital flows affect asset prices, directly by their demanding assets or indirectly through a change in money supply. Also it would be useful to know whether the effects of capital flows on asset prices differ under different currency regimes. In this analysis, we focus on the cases of emerging and developing economies in the world during the 2000s, i.e. the post 1990s-currency crisis period. As the empirical method to examine these issues, we estimate impulse responses of selected economic variables to capital flow shocks under a vector auto-regression (VAR) model.

We contribute to the aforementioned literature in the following ways. First, while the literature has concentrated on Asian and emerging economies as analytical samples, we target all of emerging and developing economies in the world, which would be available for the VAR analyses. Second, we examine how the impacts of capital flows on asset prices vary according to currency regimes. The responses of monetary policies to capital flow shocks are supposed to be different under different currency regimes. In this sense, our study could be an analytical extension of Tillmann (2012) that emphasized on the heterogeneity of monetary policy responses to capital inflow shocks.

The rest of the paper is structured as follows. The next section presents empirical analyses introducing analytical framework, data and methodology, and discussing the estimation results. The last section summarizes the results and concludes.

## 2. Empirics

This section conducts empirical estimation of the nexus between capital flows and asset prices. We first describe analytical framework, data, methodology and sample economies, and then discuss the estimate outcomes.

### 2.1 Analytical Framework

In examining the effect of capital inflows, particularly portfolio investment, on asset prices, we are concerned with its channels and its relationship with currency regime too. We then

assume the following two channels (see Diagram 1). One channel is that capital flows can directly affect the demand for assets, which can thus influence asset prices. For example, capital inflows to the stock market increase the demand for stocks, thereby causing the stock price hike. Another channel is an indirect one through a change in money supply under "pegged" currency regime. For instance, suppose that the US reduced its interest rate through her quantitative monetary easing (See Diagram 2). An emerging economy would suffer from its currency appreciation through capital inflows under its higher interest rate. If an economy adopted perfect "floating" currency regime, nothing might happen except for a direct channel above, since it would not intervene in its foreign exchange market and thus would change neither money supply nor liquidity. However, an emerging economy usually intervenes in the foreign exchange market regardless of its currency regime to avoid its currency fluctuations (the reason will be explained later), and it results in an accumulation of foreign reserves. It is at this stage where monetary policy responses vary according to its currency regime. Under a floating regime, an economy tries to sterilize its intervention to secure its monetary autonomy, thereby no change in money supply and liquidity occurring finally (its currency appreciation may reduce aggregate demands toward equilibrium following Diagram 2). On the contrary, under a pegged regime, an economy cannot help accommodating an increase in money supply and liquidity, which may then flow into asset markets and raise asset prices as a second channel. If an economy stood beyond a full-employment output level, it might get a pressure of higher inflation or asset bubbles following Diagram 2. To sum up, it is supposed that pegged regime makes capital flows affect asset prices through both direct and indirect channels, while floating regime faces only a direct channel by cutting off an indirect channel from capital flows to domestic money supply through either nonintervention or sterilization. Following this analytical framework, we can examine how the impacts and channels of capital flows on asset prices differ according to currency regimes.

The following two issues should be noted further, as long as emerging and developing economies are targeted. First, perfect floating currency regime is not feasible in emerging and developing economies. The loss of stability of exchange rate seems to be a hard choice to emerging and developing economies, since their economies are basically facing the problem of "fear of floating" (see Calvo and Reinhart; 2002). Their economies cannot escape from the constraint of "impossible trinity": economies can pursue two of three options –fixed exchange rates, monetary autonomy and capital mobility. As long as some stability of exchange rate is required in their economies, they have to sacrifice monetary autonomy to some extent or at least

have to intervene in the foreign exchange market as managed floating regime. The alternative policy option would be to resort to a direct capital control, but its workability is the question. Ostry et al. (2010) argued that the evidence appears to be stronger for capital controls to have an effect on the composition of inflows rather than on the aggregate volume.

The second point to be noted is why some emerging and developing economies have accumulated a lot of foreign reserves through their intervention, although they have allowed their currency fluctuations, whose phenomenon has come to be a puzzle for economists. Aizenman et al. (2008) explained this puzzle by the change in the role of foreign reserves. They argued that the recent literature has focused on their role as a means of self-insurance against exposure to volatile "hot money" subject to frequent sudden stops and reversals, whereas the earlier literature focused on the role of foreign reserves as a buffer stock for managing pegged exchange rate regimes. Obstfeld et al. (2008) constructed a financial-stability model to elucidate reserve holdings in the modern era of globalized capital markets, and proved that the size of domestic financial liabilities, financial openness and exchange rate policy are all significant predictors of international reserve stocks.

## 2.2 Data and Methodology

Under the above-mentioned analytical frameworks, we first identify economic variables for our VAR estimation. We focus them only on the following three variables: portfolio capital inflows (*PFI*), stock (share) prices (*STP*), monetary base (*MOB*) for the following reasons. First, we need to enlarge samples of emerging and developing economies in the world for our estimation by narrowing down the targeted variables. Second, we need to secure the degree of freedom in our VAR estimation within the limited range of time-series data, i.e., 44 quarters during the sample period from 2000 to 2010. *PFI* includes both "equity & investment fund shares" and "debt securities", and shows "net" inward investment, i.e., portfolio investment in liabilities minus portfolio investment in assets. *PFI* is expressed as a percentage ratio to GDP. *STP* is signified as index numbers (2005=100) in terms of period averages. MOB is expressed as a percentage ratio to GDP and as seasonally adjusted series by Census X12. Only for the observation of sample economies, we add a variable of foreign reserves (*RES*), which is also expressed as a percentage ratio to GDP. All the data for the economic variables above are

retrieved from the International Financial Statistics (IFS) of the International Monetary Fund (IMF).[1]

We then construct the VAR model. VAR modeling is useful for identifying the effects of capital inflows on asset prices in case the variables are interrelated in the aforementioned two kinds of channels, and for inferring their dynamic effects. Kim and Yang (2009 and 2011) and Tillmann (2012), which were shown in the literature review, adopted a VAR model to investigate the contribution of capital inflows to asset price hikes in the case of Asian emerging economies. We basically follow their model, and apply it to our concern. We specify the VAR model in the following way:

$$y_t = \mu + V_1 y_{t-1} + V_2 y_{t-2} + \varepsilon_t \qquad (1)$$

where $y_t$ is a $(3 \times 1)$ column vector of the endogenous variables, $y_t = (dPFI_t\ dSTP_t\ dMOB_t)'$, $\mu$ is a $(3 \times 1)$ constant vector, each of $V_1$ and $V_2$ is a $(3 \times 3)$ coefficient matrix, each of $y_{t-1}$ and $y_{t-2}$ is a $(3 \times 1)$ vector of the lag endogenous variables, and $\varepsilon_t$ is a $(3 \times 1)$ vector of the random error terms in the system. The lag length, i.e., two quarters, is selected to capture dynamic interactions of the variables to the maximum extent under the constraint that we have to secure the degree of freedom within the limited range of time-series data, , i.e., 44 quarters. Each economic variable is shown in terms of first difference to make their time series data stationary while the levels of their data have usually a unit root, as are shown in the later section.

Based on the VAR model (1), we examine the impulse responses of each variable to portfolio inflows shocks. It enables us to identify the aforementioned two channels from portfolio inflows towards asset prices hike: When we see significantly positive responses of share prices, if there are no responses in monetary base, it implies only a direct channel working; but if there are also significantly positive responses in monetary base, it suggests both of direct channel and indirect one working together. From the analytical framework above, we suppose that the economies with pegged currency regime could have the impacts of capital flows on asset prices through both of the channels, while those with floating regime could have the effects through only a direct channel. Regarding the methodology to define the impulse responses, we

[1] We basically use the IFS CD-ROM in April 2013, but link it with that in June 2011 in case that the former does not trace back the data well in some time-series variables.

adopt the "generalized impulse response" proposed by Pesarana and Shinb (1998). This approach, unlike the traditional impulse response analysis, does not require orthogonalization of shocks and is invariant to the ordering of the variables in the VAR model. By using this method, we trace four quarters (one year) to examine dynamic effects in accumulated terms.[2]

2.3 Selection of Sample Economies

We herein clarify the selection process of samples from emerging and developing economies in the world. The sample period is, as we mentioned, the one from the 1st quarter of 2000 to the 4th quarter of 2010. The reason why we focus on the 2000s is that the 1990s include currency crises and changes in currency regime in many economies, and the 2000s have intensified capital flows to emerging market economies in line with financial integration.

We take the following three steps for selecting sample economies. First, we sort out the samples by the data availability for three key variables, *PFI*, *STP*, and *MOB* (see Table 1) Among the 159 emerging and developing economies listed in IFS, it is only 23 economies in which the data for all three variables are available on quarterly basis during the sample period of the 2000s.

Second, we examine each of 23 economies by its currency regime, and extract the economies without changes in regimes during the sample period by removing those with mixed regimes. For the classification of currency regimes, we use the "Exchange Rate Regime Reinhart and Rogoff Classification".[3] The IMF represents exchange rate arrangements of the Fund members. However, its classification is often criticized as the one that does not necessarily reflect actual exchange rate arrangements, since it is based on the details that Fund members formally announced. Many economists, therefore, have often shown their own analysis of the de facto exchange rate regimes. One of the famous and latest estimates is the Reinhart and Rogoff Classification above, which reclassified exchange rate regimes by employing newly compiled monthly data sets on market-determined exchange rates. Table 2 represents "Annual coarse classification" on the 23 economies for 2000-2010. We name the economies with any regime changes "Mixed", those classified into 1 and 2 "Peg" and those classified into 3 and 4 "Float".[4]

[2] The details of "generalized impulse response" are described in the EViews 7 Users' Guide.
[3] See http://www.carmenreinhart.com/data/browse-by-topic/topics/11/.
[4] Russia has changed its regime in 2010, but is classified into "Peg" since we exclude 2010 from estimation later.

We can finally get 15 economies (8 of "Float" and 7 of "Peg) by removing 8 of "Mixed" (see again Table 1).

As the final step, we investigate the stationary property of time-series data for the three variables in each of 15 samples by a unit root test for the VAR estimation later on. For a unit root test, the augmented Dickey-Fuller (ADF) test (Said & Dickey, 1984) and the Philips-Perron (PP) (Philips & Perron, 1988) test have often been used. It is well-known, however, that both the ADF and PP suffer from severe size and power problems depending on the nature of the process. Accordingly, Ng and Perron (2001) introduce a new unit root test, which uses detrended data and a lag selection procedure that improves on previous methods. This study, thus, adopts the Ng and Perron test on the null hypothesis that a level and/or a first deference of each variable have a unit root, by choosing to include "trend and intercept" in the test equation judging from data observation. This test constructs four test statistics that are based upon the detrended data. These test statistics are modified forms of Phillips and Perron and statistics (MZa, MZt), the Bhargava (1986) statistic (MSB), and the ERS Point Optimal statistic (MPT).[5] Table 3 reports that for a level of data there are no economies in which the null hypothesis of a unit root is rejected for all three variables, and for a first difference there are 10 economies where the hypotheses is rejected for all three, among 15 economies.

In all, we finally select 10 sample economies (6 of "Float" and 4 of "Peg") for the VAR model estimation, which clear all the conditions: data availability, no changes in currency regimes, and data stationarity for the sample period (see Table 1 again). We herein take an overview on the 10 sample economies by graphing the three key data, *PFI*, *STP* and *MOB*, as well as foreign reserves, *RES*, in each economy. Figure 1 shows us that there appears to be very rough synchronization between capital inflow (*PFI*) and stock prices (*STP*) in sample economies except Croatia and Russia, and that there seems to be no clear relationship between capital inflow (*PFI*) and monetary base (*MOB*). An interesting fact is that as typically shown in Thailand there has been no increase in monetary base in spite of a rapid accumulation of foreign reserves, which implies the existence of sterilization of foreign exchange intervention. These rough observations will statistically tested by VAR model estimation in the following section.

## 2.4 Discussion on Estimate Outcomes

[5] All the tests are described in details in the EViews 7 Users' Guide.

We herein conduct VAR model estimation on three key variables: portfolio capital inflows (*PFI*), stock prices (*STP*) and monetary base (*MOB*), based on Equation (1) for ten selected sample economies during the 2000s in quarterly terms. The outcome of VAR estimation is shown in Appendix, and that of the estimation for generalized impulse responses to capital inflow (*PFI*) shocks in Table 4. Table 4 reports that stock prices positively respond to capital inflow shocks at more-than-90-percent significant levels within four quarters in all the sample economies but Croatia and Russia; monetary base positively respond to the shocks at the significant level simultaneously with stock price responses in India and Peru, which belong to pegged currency regime; significant response of monetary base to the shock in the third quarter in Indonesia appears after its stock price responses.

We interpret the estimation outcomes above in the following ways. First, portfolio capital inflows have a significantly positive effect on stock prices in all sample economies except transition economies, which implies that the direct channel from capital inflows into stock markets is at least working in sample economies regardless of their currency regimes. In fact, the positive responses of stock prices to capital inflow shocks do not accompany any responses of monetary base to the shocks (even in Indonesia the monetary base response comes later than the stock price response) in the economies with floating currency regime. This effect means nothing but the direct channel in which capital inflows directly go into stock market, thereby raising stock prices. We speculate the reason for no significant responses of stock prices to capital inflows shocks in such transition economies as Croatia and Russia. In these economies, stock market may have not been well developed yet in their financial system. When we compare money multipliers, the index representing financial deepening, in the two transition economies with those in the other sample economies, the former are extremely lower than the latter (see rightest column in Table 4). This may indirectly suggest the immature development in their stock market.

Second, the indirect channel –the channel in which capital inflows raise share prices through an increase in domestic monetary base– seems to work differently under the sample economies with different currency regimes; it works in the economies with peg regime like India and Peru, whereas it does not in those with floating regime like Brazil, Chile, Colombia, Indonesia, Mexico and Thailand. In fact, it is only in India and Peru that the positive responses of monetary base to capital inflow shocks together with the positive response of stock prices are identified in our estimation. The stock price responses in India and Peru would be rather larger and more

persistent than those in the sample economies with floating regime. These findings appear to be consistent with Tillmann (2012) that attributed the cross-country difference in asset price responses to the heterogeneity of monetary policy responses. As we mentioned in the analytical framework, once emerging and developing economies face capital inflows and intervene in the foreign exchange market, the economies with pegged regime allow the intervention to lead to an increase in monetary base, which causes liquidity flows into stock market and a surge in stock prices, whereas those with floating regime sterilize the intervention through an open market operation, thereby no change in money supply and liquidity happening.

## 3. Concluding Remarks

This paper aims at providing empirical evidence on the effect of capital flows on asset prices including its channel under different currency regimes, focusing on ten emerging and developing economies in the world with data availability and stationarity for the 2000s, by a generalized impulse response analysis under a vector auto-regression model. The main findings are as follows. Portfolio capital inflows have a significantly positive effect on stock prices in all sample economies except two transition economies, which implies that the direct channel from capital inflows into stock markets is at least working in sample economies regardless of their currency regimes; The indirect channel –the channel in which capital inflows raise share prices through an increase in domestic monetary base– works differently under different currency regimes: it works in the economies with peg regime through their intervention to foreign exchange markets, whereas the indirect channel seems to be shut down in those with floating regime probably by sterilizing the intervention.

With respect to the policy implications of these findings, the difference in responses of economic variables to capital inflows shocks under different currency regimes affects the policy options among macroeconomic policy, prudential policy and capital controls. Under floating regime, the sterilization of capital inflows as a macroeconomic policy can be one of the key options as Caballero and Krishnamurthy (2006) suggested in the context of risk management. Under peg regime without the sterilization instrument, the heavier burdens might be imposed on domestic prudential measures to avoid boom-bust cycle under massive capital inflows.

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**Diagram 1 Two Channels from Capital Flows and Asset Prices**

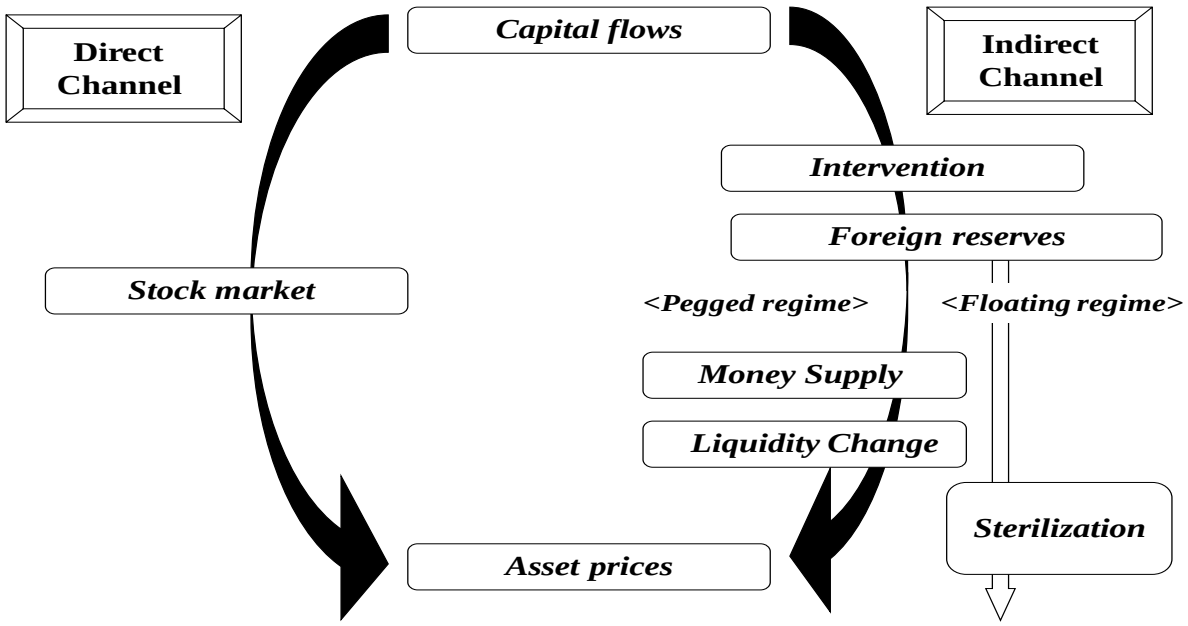



**Diagram 2 Two Channels under Mundell-Fleming Framework**

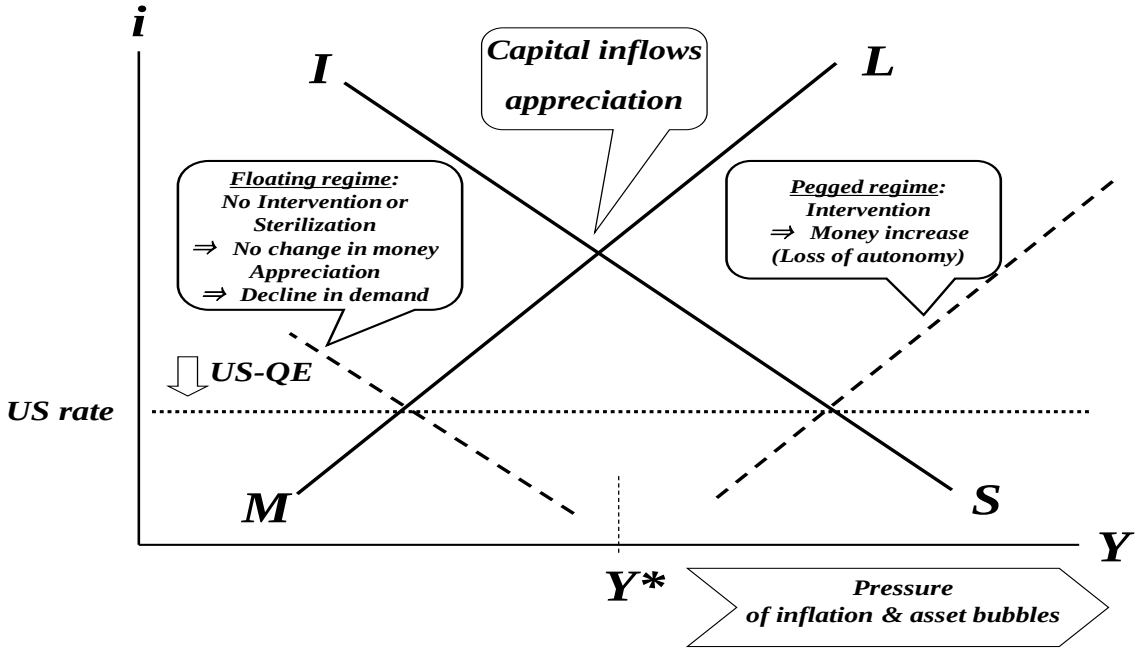


**Table 1 Selection of Sample Economies**

| Countries | Data Availability | Currency Regime | Data Stationarity |
|---|---|---|---|
| Argentina | Available | Mixed | |
| Brazil | Available | Float | Yes |
| Bulgaria | Available | Peg | No |
| Chile | Available | Float | Yes |
| Colombia | Available | Float | Yes |
| Croatia | Available | Peg | Yes |
| Hungary | Available | Mixed | |
| India | Available | Peg | Yes |
| Indonesia | Available | Float | Yes |
| Latvia | Available | Mixed | |
| Lithuania | Available | Mixed | |
| Malaysia | Available | Mixed | |
| Mauritius | Available | Peg | No |
| Mexico | Available | Float | Yes |
| Morocco | Available | Mixed | |
| Peru | Available | Peg | Yes |
| Philippines | Available | Mixed | |
| Poland | Available | Float | No |
| Russia | Available | Peg | Yes |
| South Africa | Available | Float | No |
| Thailand | Available | Float | Yes |
| Turkey | Available | Mixed | |
| Ukraine | Available | Peg | No |

Note: The data are not available in Afghanistan, Albania, Algeria, Angola, Anguilla, Antigua and Barbuda, Armenia, Aruba, Azerbaijan, Bahamas, Bahrain, Bangladesh, Barbados, Belarus, Belize, Benin, Bhutan, Bolivia, Bosnia and Herzegovina, Botswana, Brunei Darussalam, Burkina Faso, Burundi, Cambodia, Cameroon, Cape Verde, Central Africa, Chad, China, Comoros, Congo, Dem. Rep. of, Congo, Rep. of, Costa Rica, Cote d'Ivoire, Curacao & Sint Maarten, Djibouti, Dominica, Dominican Republic, Ecuador, Egypt, El Salvador, Equatorial Guinea, Eritrea, Ethiopia, Fiji, Gabon, Gambia, Georgia, Ghana, Grenada, Guatemala, Guinea, Guinea Bissau, Guyana, Haiti, Honduras, Iran, Iraq, Jamaica, Jordan, Kazakhstan, Kenya, Kosovo, Kuwait, Kyrgyz, Lao, Lebanon, Lesotho, Liberia, Libya, Macedonia, Madagascar, Malawi, Maldives, Mali, Mauritania, Micronesia, Moldova, Mongolia, Montenegro, Montserrat, Mozambique, Myanmar, Namibia, Nepal, Netherlands Antilles, Nicaragua, Niger, Nigeria, Oman, Pakistan, Panama, Papua New Guinea, Paraguay, Qatar, Romania, Rwanda, Samoa, Sao TomE & Prucipe, Saudi Arabia, Senegal, Serbia, Seychelles, Sierra Leone, Slovak Republic, Solomon Islands, Somalia, Sri Lanka, St. Kitts and Nevis, St. Lucia, St. Vincent & Grenadines, Sudan, Suriname, Swaziland, Syria, Tajikistan, Tanzania, Timor-Leste, Togo, Tonga, Trinidad and Tobago, Tunisia, Uganda, United Arab Emirates, Uruguay, Vanuatu, Venezuela, Vietnam, West Bank and Gaza, Yemen Arab Rep., Yemen, P.D. Rep., Yemen, Republic of, Yugoslavia, Zambia, and Zimbabwe.

Source: IFS.

**Table 2 Currency Regimes**

| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Argentina | 1 | 1 | 5 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | Mixed |
| Brazil | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | Float |
| Bulgaria | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | Peg |
| Chile | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | Float |
| Colombia | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | Float |
| Croatia | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | Peg |
| Hungary | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | Mixed |
| India | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | Peg |
| Indonesia | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | Float |
| Latvia | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 1 | Mixed |
| Lithuania | 1 | 1 | 1 | 1 | 3 | 2 | 2 | 1 | 1 | 2 | 2 | Mixed |
| Malaysia | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 3 | 3 | 3 | Mixed |
| Mauritius | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | Peg |
| Mexico | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | Float |
| Morocco | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | Mixed |
| Peru | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | Peg |
| Philippines | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | Mixed |
| Poland | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | Float |
| Russia | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | Peg |
| South Africa | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | Float |
| Thailand | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | Float |
| Turkey | 3 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | Mixed |
| Ukraine | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | Peg |

Note

1: No separate legal tender;
Pre announced peg or currency board arrangement;
Pre announced horizontal band that is narrower than or equal to +/-2%
De facto peg

2: Pre announced crawling peg
Pre announced crawling band that is narrower than or equal to +/-2%
De factor crawling peg
De facto crawling band that is narrower than or equal to +/-2%

3: Pre announced crawling band that is wider than or equal to +/-2%
De facto crawling band that is narrower than or equal to +/-5%
Moving band that is narrower than or equal to +/-2% (i.e., allows for both appreciation and depreciation over time)
Managed floating

4: Freely floating

5: Freely falling

Source: http://www.carmenreinhart.com/data/browse-by-topic/topics/11/

Source: IFS.

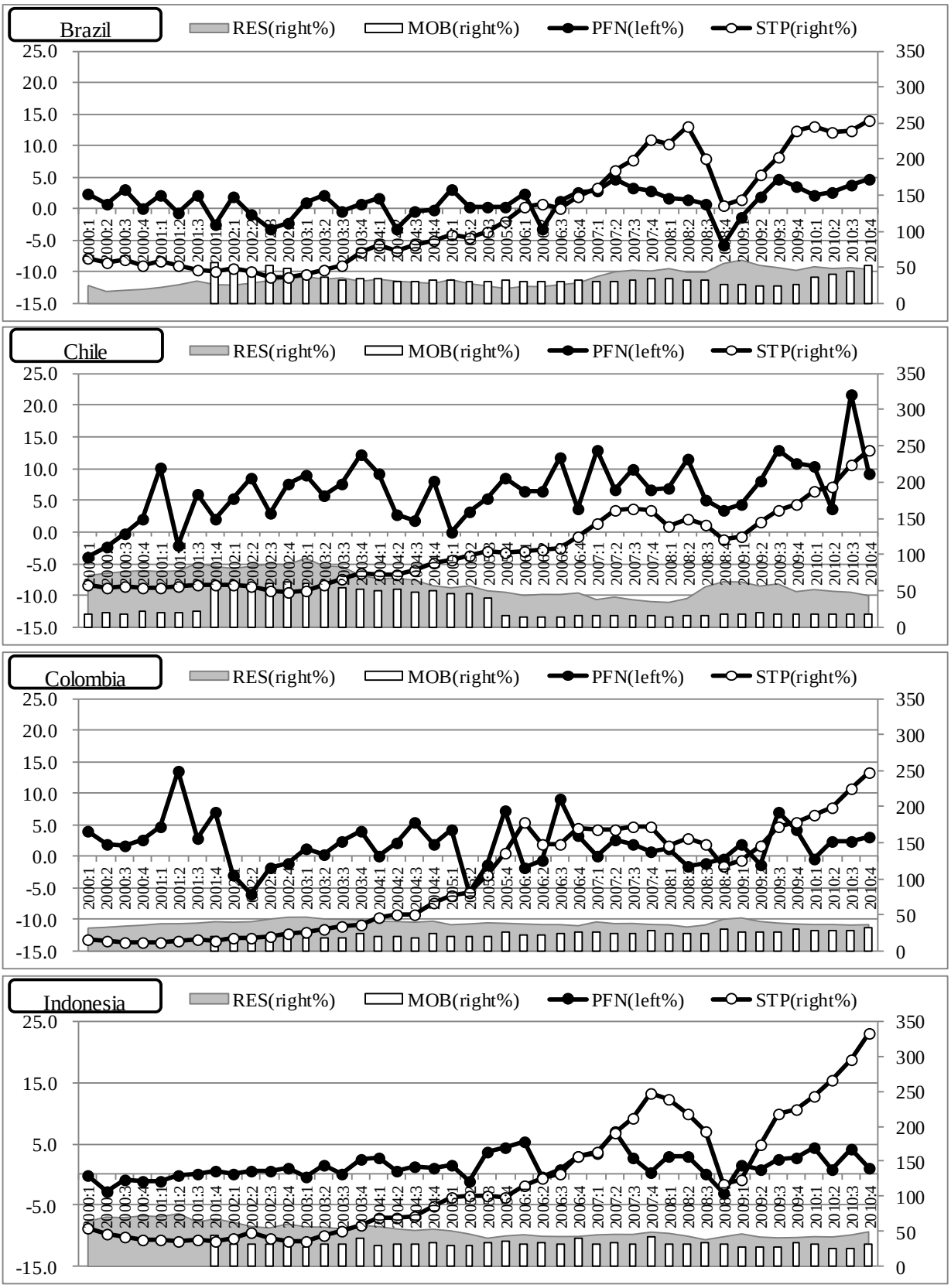
## Table 3 Outcomes of Ng and Perron Test

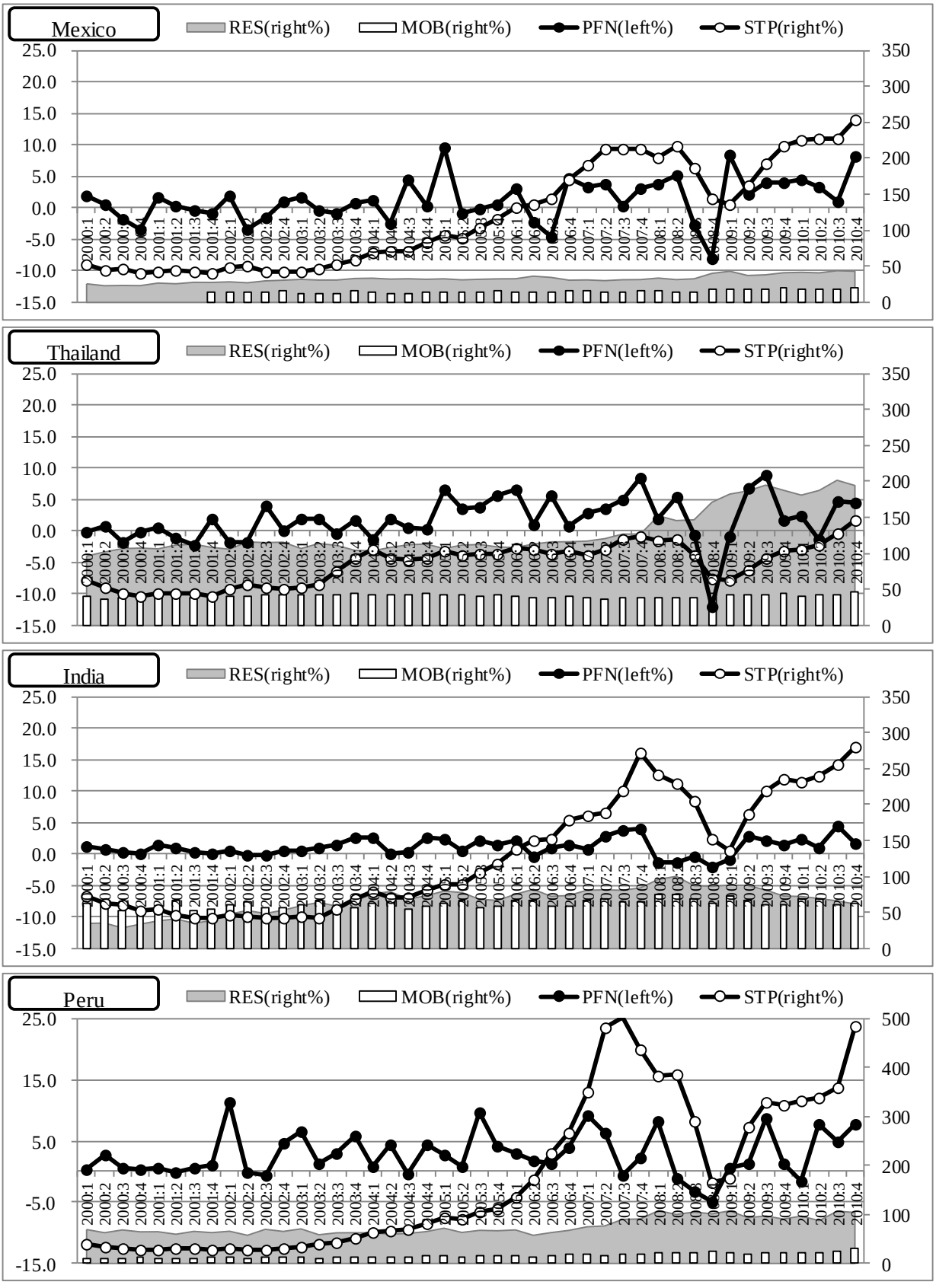
| | | Level | | | | First Difference | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | MZa | MZt | MSB | MPT | MZa | MZt | MSB | MPT |
| | PFN | -21.38** | -3.26** | 0.15** | 4.30** | -19.55** | -3.12** | 0.15** | 4.66** |
| Brazil | STP | -14.86* | -2.69* | 0.18 | 6.31* | -23.22** | -3.40** | 0.14** | 3.92*** |
| | MOB | -3.60 | -1.11 | 0.31 | 21.87 | -20.22** | -3.15** | 0.15** | 4.63** |
| | PFN | -10.56 | -2.29 | 0.21 | 8.65 | -11.22 | -2.36 | 0.21 | 8.11 |
| Bulgaria | STP | -7.26 | -1.80 | 0.24 | 12.70 | -16.29* | -2.85* | 0.17* | 5.59* |
| | MOB | -3.93 | -1.09 | 0.27 | 19.66 | -20.76** | -3.15** | 0.15** | 4.77** |
| | PFN | -24.21*** | -3.46*** | 0.14** | 3.83*** | -38.14*** | -4.35*** | 0.11*** | 2.42*** |
| Chile | STP | -11.79 | -2.42 | 0.20 | 7.73 | -23.53** | -3.42*** | 0.14** | 3.88*** |
| | MOB | -3.52 | -1.32 | 0.37 | 25.86 | -24.53*** | -3.49*** | 0.14*** | 3.76*** |
| | PFN | -24.44*** | -3.48*** | 0.14*** | 3.82*** | -39.82*** | -4.45*** | 0.11*** | 2.34*** |
| Colombia | STP | -7.37 | -1.91 | 0.25 | 12.37 | -24.73*** | -3.51*** | 0.14*** | 3.68*** |
| | MOB | -14.43* | -2.64* | 0.18* | 6.57* | -18.79** | -3.06** | 0.16** | 4.87** |
| | PFN | -24.86*** | -3.52*** | 0.14*** | 3.67*** | -18.94** | -3.00** | 0.15** | 5.27** |
| Croatia | STP | -9.49 | -2.12 | 0.22 | 9.80 | -19.57** | -3.12** | 0.15** | 4.67** |
| | MOB | -2.50 | -1.09 | 0.40 | 31.41 | -21.14** | -3.24** | 0.15** | 4.33** |
| | PFN | -13.96 | -2.59 | 0.18 | 6.81 | -76.10*** | -6.15*** | 0.08*** | 1.24*** |
| India | STP | -13.73 | -2.56 | 0.18 | 6.95 | -18.55** | -3.03** | 0.16** | 4.97** |
| | MOB | -8.60 | -2.06 | 0.24 | 10.61 | -20.41** | -3.19** | 0.15** | 4.46** |
| | PFN | -21.97** | -3.27** | 0.14** | 4.38** | -21.18** | -3.23** | 0.15** | 4.40** |
| Indonesia | STP | -10.45 | -2.19 | 0.20 | 0.16 | -22.38** | -3.34** | 0.14** | 4.07** |
| | MOB | -15.45* | -2.73** | 0.17* | 6.14* | -19.26** | -3.09** | 0.16** | 4.78** |
| | PFN | -19.28** | -3.08** | 0.16** | 4.83** | -15.12* | -2.53 | 0.16** | 7.24 |
| Mauritius | STP | -10.16 | -2.20 | 0.21 | 9.18 | -55.06*** | -5.24*** | 0.09*** | 1.68*** |
| | MOB | -9.66 | -2.07 | 0.21 | 9.94 | -17.59** | 2.94** | 0.16** | 5.28** |
| | PFN | -24.63*** | -3.46*** | 0.14*** | 3.95*** | -1191*** | -24.40*** | 0.02*** | 0.07*** |
| Mexico | STP | -16.54* | -2.84* | 0.17* | 5.69* | -20.20** | -3.17** | 0.15** | 4.51** |
| | MOB | -6.82 | -1.83 | 0.26 | 13.36 | -20.19** | -3.17** | 0.15** | 4.52** |
| | PFN | -24.38*** | -3.48*** | 0.14*** | 3.78*** | -21.05** | -3.21** | 0.15** | 4.50** |
| Peru | STP | -20.60** | -3.20** | 0.15** | 4.42** | -42.32*** | -4.59*** | 0.10*** | 2.16*** |
| | MOB | 0.23 | 0.06 | 0.29 | 30.25 | -35.11*** | -3.96*** | 0.11*** | 3.79*** |
| | PFN | -22.80** | -3.36** | 0.14** | 4.04** | -21.27** | -3.26** | 0.15** | 4.28** |
| Poland | STP | -15.72* | -2.79* | 0.17* | 5.82* | -17.38** | -2.93** | 0.16* | 5.31** |
| | MOB | -4.82 | -1.51 | 0.31 | 18.65 | -11.96 | -2.43 | 0.20 | 7.65 |
| | PFN | -24.60*** | -3.50*** | 0.14*** | 3.72*** | -21.60** | -3.28** | 0.15** | 4.22** |
| Russia | STP | -14.53* | -2.66* | 0.18* | 6.46* | -21.94** | -3.31** | 0.15** | 4.15** |
| | MOB | -8.80 | -2.01 | 0.22 | 10.63 | -22.93** | -3.38** | 0.14** | 4.00*** |
| | PFN | -23.57** | -3.43*** | 0.14** | 3.86*** | -21.18** | -3.25** | 0.15** | 4.30** |
| South Africa | STP | -12.73 | -2.51 | 0.19 | 7.20 | -12.52 | -2.49 | 0.19 | 7.30 |
| | MOB | -7.17 | -1.88 | 0.26 | 12.70 | -17.32** | -2.93** | 0.16* | 5.32** |
| | PFN | -20.36** | -3.18** | 0.15** | 4.48** | -19.33** | -3.10** | 0.16** | 4.71** |
| Thailand | STP | -24.15*** | -3.41** | 0.14*** | 4.11** | -19.19** | -3.06** | 0.15** | 4.96** |
| | MOB | -7.44 | -1.88 | 0.25 | 12.32 | -19.67** | -3.13** | 0.15** | 4.63** |
| | PFN | -7.66 | -1.93 | 0.25 | 11.95 | -1.85 | -0.88 | 0.47 | 43.59 |
| Ukraine | STP | -35.83*** | -4.15*** | 0.11*** | 2.99*** | -33.87*** | -4.11*** | 0.12*** | 2.70*** |
| | MOB | -9.49 | -2.04 | 0.21 | 10.15 | -18.22** | -2.96** | 0.16** | 5.31** |

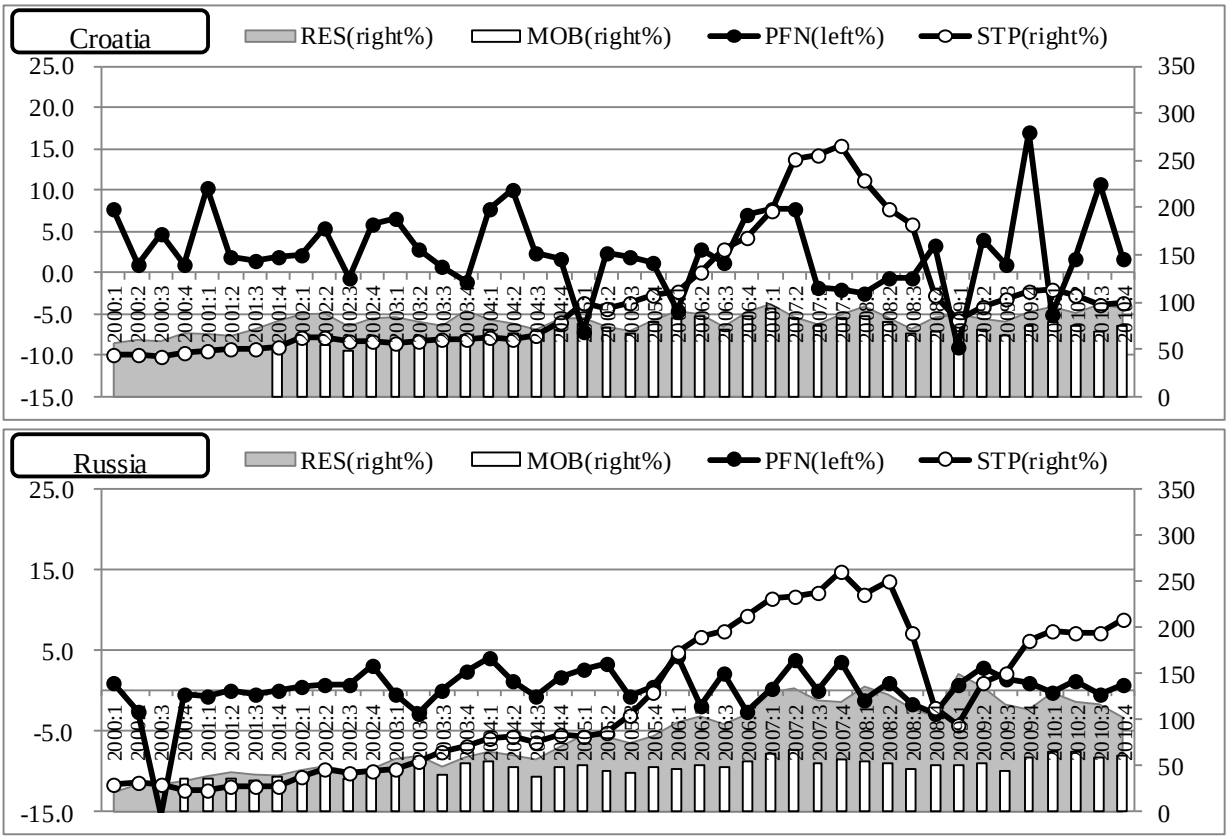
Note: ***, **, and * indicate rejection of the null of a unit root at the 1 percent, 5 percent, and 10 percent significance levels with critical values.

Source: IFS.

**Figure 1Overview on Sample Economies**




Mexico
RES(right%)
MOB(right%)
PFN(left%)
STP(right%)
Thailand
India
Peru


Croatia
RES(right%)
MOB(right%)
PFN(left%)
STP(right%)
25.0
20.0
15.0
10.0
5.0
0.0
-5.0
-10.0
-15.0
350
300
250
200
150
100
50
0
Russia
RES(right%)
MOB(right%)
PFN(left%)
STP(right%)
25.0
15.0
5.0
-5.0
-15.0
350
300
250
200
150
100
50
0

Source: IFS.

## Table 4 Generalized Impulse Responses to Capital Inflow Shock

| | STP | | | | MOB | | | | Money |
|---|---|---|---|---|---|---|---|---|---|
| | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Multiplier |
| [Floating Economies] | | | | | | | | | |
| Brazil | 10.491*** | 15.754*** | 15.563** | 13.108** | -0.009 | 0.066 | 0.714 | 0.684 | 7.45 |
| | (3.104) | (5.407) | (6.732) | (6.331) | (0.462) | (0.860) | (1.253) | (1.532) | |
| Chile | 3.420** | 3.395 | 1.932 | 3.114 | -0.972 | -1.473 | -3.901 | -2.452 | 14.67 |
| | (1.475) | (2.635) | (3.498) | (3.563) | (1.016) | (1.604) | (2.091) | (2.080) | |
| Colombia | 1.849 | 6.902* | 5.162 | 3.029 | -0.079 | -0.195 | -0.155 | -0.080 | 5.53 |
| | (2.650) | (4.052) | (4.640) | (4.286) | (0.132) | (0.146) | (0.166) | (0.132) | |
| Indonesia | 5.968** | 10.059* | 11.515 | 8.272 | 0.433 | 0.179 | 1.005** | 0.582 | 4.94 |
| | (3.001) | (5.991) | (8.580) | (9.075) | (0.349) | (0.392) | (0.437) | (0.367) | |
| Mexico | 8.391*** | 13.228*** | 12.900** | 10.448* | -0.141 | -0.333 | -0.395 | -0.339 | 12.81 |
| | (2.146) | (2.765) | (2.688) | (2.190) | (0.082) | (0.130) | (0.168) | (0.171) | |
| Thailand | 3.193** | 6.042** | 5.674* | 4.553 | -0.358 | -0.412 | -0.541 | -0.413 | 11.00 |
| | (1.315) | (2.540) | (3.249) | (3.138) | (0.181) | (0.218) | (0.244) | (0.209) | |
| [Pegged Economies] | | | | | | | | | |
| India | 12.974*** | 19.690*** | 22.769*** | 22.676*** | 0.511** | 0.561* | 0.662 | 1.133*** | 4.81 |
| | (2.656) | (4.835) | (7.035) | (8.227) | (0.258) | (0.320) | (0.412) | (0.438) | |
| Peru | 11.413** | 25.835*** | 26.850** | 9.672 | 0.368*** | 0.450** | 0.655** | 0.604** | 6.03 |
| | (5.272) | (9.821) | (12.805) | (13.931) | (0.132) | (0.197) | (0.262) | (0.290) | |
| Croatia | -0.252 | 1.240 | 3.944 | 4.198 | 0.400 | 0.149 | 0.652 | 0.318 | 3.45 |
| | (3.160) | (5.868) | (7.995) | (8.724) | (0.519) | (0.748) | (0.925) | (0.860) | |
| Russia | 4.417 | 2.242 | 5.393 | 5.200 | 0.446 | 0.180 | 0.139 | 0.298 | 2.61 |
| | (3.593) | (6.658) | (8.562) | (8.532) | (0.628) | (0.899) | (0.940) | (0.730) | |

Note:

1) ***, **, and * indicate rejection of the null hypothesis at the 1 percent, 5 percent, and 10 percent significance levels.
2) Money multiplier denotes "Broad Money" divided by monetary base.

Source: IFS.

## Appendix VAR Model Estimation

| | | D(PFN$_{-1}$) | D(PFN$_{-2}$) | D(STP$_{-1}$) | D(STP$_{-2}$) | D(MOB$_{-1}$) | D(MOB$_{-2}$) | C | adj. R^2 |
|---|---|---|---|---|---|---|---|---|---|
| | D(PFN) | -0.424** | -0.090 | 0.039 | -0.070** | -0.026 | 0.133 | 0.424 | 0.151 |
| Brazil | D(STP) | 0.404 | 0.323 | 0.408* | -0.265 | -0.999 | 0.846 | 5.365 | 0.010 |
| | D(MOB) | -0.321 | 0.250 | 0.081** | -0.057* | 0.381** | 0.402** | 0.119 | 0.346 |
| | D(PFN) | -0.854*** | -0.309 | 0.036 | 0.011 | -0.040 | 0.122 | 0.597 | 0.378 |
| Chile | D(STP) | -0.329 | -0.620 | 0.455** | 0.030 | 0.016 | -0.122 | 2.946* | 0.082 |
| | D(MOB) | -0.036 | -0.498* | -0.045 | 0.005 | 0.177 | 0.133 | 0.241 | 0.036 |
| | D(PFN) | -0.547*** | -0.549*** | 0.002 | 0.009 | -0.281 | 0.225 | 0.223 | 0.351 |
| Colombia | D(STP) | 1.365** | 0.092 | 0.190 | -0.057 | 1.427 | 1.985 | 4.575 | 0.008 |
| | D(MOB) | -0.038 | -0.014 | -0.005 | 0.005 | -0.363* | 0.082 | 0.386** | 0.081 |
| | D(PFN) | -0.350* | -0.311* | 0.011 | -0.002 | -0.197 | 0.316 | 0.041 | 0.179 |
| Indonesia | D(STP) | 0.933 | -0.166 | 0.686*** | -0.131 | -4.902*** | -1.559 | 2.356 | 0.348 |
| | D(MOB) | -0.012 | 0.234 | 0.010 | 0.044 | -0.665*** | -0.452** | -0.801** | 0.327 |
| | D(PFN) | -0.841*** | -0.392** | 0.069 | -0.127* | 1.205 | 0.427 | 0.487 | 0.305 |
| Mexico | D(STP) | 0.050 | 0.005 | 0.634*** | -0.182 | 5.009 | 5.380 | 2.271 | 0.173 |
| | D(MOB) | -0.029 | -0.023 | -0.007 | -0.000 | 0.012 | 0.119 | 0.162 | 0.017 |
| | D(PFN) | -0.446*** | -0.255* | 0.178** | -0.166** | 1.541*** | 0.448 | -0.188 | 0.385 |
| Thailand | D(STP) | 0.506 | -0.248 | 0.630*** | -0.269 | 2.553** | -1.286 | 1.339 | 0.279 |
| | D(MOB) | -0.018 | -0.019 | -0.037 | 0.012 | -0.360** | 0.120 | 0.223 | 0.044 |
| | D(PFN) | -0.188 | -0.165 | -0.016 | -0.015 | -0.042 | -0.304* | 0.154 | 0.178 |
| India | D(STP) | 2.330 | 1.000 | 0.256 | 0.153 | 0.523 | -1.667 | 1.595 | 0.016 |
| | D(MOB) | -0.139 | -0.327 | 0.041* | 0.025 | -0.588*** | -0.200 | 0.267 | 0.191 |
| | D(PFN) | -0.575*** | -0.415** | 0.012 | -0.018 | -0.299 | -1.957** | 0.994 | 0.288 |
| Peru | D(STP) | 2.657** | 2.567* | 0.577*** | -0.361** | -8.969 | -18.694** | 16.945*** | 0.459 |
| | D(MOB) | 0.023 | 0.049 | -0.004 | 0.004 | 0.107 | 0.167 | 0.318* | -0.033 |
| | D(PFN) | -0.648*** | -0.205 | 0.026 | -0.063 | 0.152 | 0.010 | 0.017 | 0.196 |
| Croatia | D(STP) | 0.053 | 0.427 | 0.250 | 0.087 | 2.977** | 1.023 | -2.207 | 0.261 |
| | D(MOB) | -0.036 | 0.035 | -0.018 | 0.009 | -0.019 | 0.316 | 0.346 | -0.069 |
| | D(PFN) | -0.713*** | -0.231 | 0.002 | -0.026 | 0.169 | 0.188 | 0.043 | 0.265 |
| Russia | D(STP) | -1.800 | 0.534 | 0.555*** | -0.278 | -0.298 | 2.857** | 2.388 | 0.198 |
| | D(MOB) | -0.136 | -0.106 | 0.017 | 0.018 | -0.051 | -0.146 | 0.672 | -0.144 |

Note: ***, **, and * indicate rejection of the null hypothesis at the 1 percent, 5 percent, and 10 percent significance levels.

Source: IFS.